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## Effect and Outcome of Balloon Angioplasty and Stenting of the Iliac Arteries Evaluated by Intravascular Ultrasound

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**Objectives:** to document the mechanism of percutaneous transluminal angioplasty (PTA) and stenting of the iliac arteries, and to relate the effect to patency.

**Materials and methods:** thirty-seven stenotic iliac arteries were examined by intravascular ultrasound (IVUS) and arteriography before and after PTA, and after stent deployment (n=16). The patients were followed prospectively by duplex scanning at 3, 6, 12, 18 and 24 months after the intervention.

**Results:** the effect of PTA was established by both compression and stretching with the major contribution arising from stretching. There were differences in the effect of PTA dependent on plaque morphology: in homogeneous eccentric lesions, stretching contributed significantly more than compression to the luminal gain, while stretching and compression contributed equally in concentric or heterogeneous plaques. Stenting of the arteries had no effect on the free luminal area as measured by IVUS. The primary 1-year patency rate was 72%. The patency was related to the free luminal area and diameter and the heterogeneity of the plaque as evaluated by IVUS. The arteriographic measurements did not have any predictive value.

**Conclusion:** IVUS was able to document the effect of PTA and stenting in the iliac arteries, and predict the outcome. The luminal gain and reduction in degree of stenosis seemed to be accomplished primarily by stretching of the arteries and to a lesser extent by plaque compression. Stenting did not change the IVUS measurements. Patency was related to the size of the free lumen and the heterogeneity of the plaque.

**Key Words:** Intravascular ultrasound; Percutaneous transluminal angioplasty; Peripheral arteries; Atherosclerosis.

### Introduction

Percutaneous transluminal angioplasty (PTA) of iliac stenosis is a well established treatment, due to the low morbidity and the relatively high patency of the intervention. Knowledge about the exact mechanism is, however, scarce since arteriography, necropsy and animal studies were the only way of obtaining information about this subject. With the introduction of intravascular ultrasound, supplying cross-sectional images of the vessels with a high resolution, the mechanism of PTA, especially in the coronary arteries, has been studied thoroughly.<sup>1–6</sup> The effect of femoral PTA has been described in a few studies,<sup>7–9</sup> while only two studies have described the effect of iliac PTA using IVUS<sup>10,11</sup> and the most recent of these papers describes the findings in vague and general terms.<sup>11</sup> Also, the effect of stenting has been more widely studied by IVUS in the coronary arteries,<sup>12–15</sup> while the effect of

iliac artery stenting has been studied in detail only in a combined *in vitro* and animal study<sup>16</sup> in addition to the above mentioned paper.<sup>11</sup> As the iliac segment is one of the most frequently stented peripheral arteries, we wanted to investigate the effect of PTA and stent using IVUS, and to relate these results to patency. The value of IVUS in predicting the outcome after iliac PTA and/or stenting is another area not described in the literature.

### Materials and Methods

From July 1993 to June 1997, 36 patients, 17 men and 19 women, median age 64 (range 45–77) scheduled for PTA of the iliac arteries were studied. One patient had bilateral common iliac lesions. There were 25 stenoses situated in the common iliac artery and 12 stenoses in the external iliac artery. The median length of the stenoses was 1.5 cm (range 0.5–5). In 29 cases both the superficial and the deep femoral arteries were patent, while the remaining patients only had run off via one

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of these arteries. The indications for angioplasty were rest pain in three cases (8%), ulceration in one case (3%), disabling claudication in 30 cases (81%), while three patients (8%) were asymptomatic, but treated to avoid inflow problems to a crossover bypass, which was inserted simultaneously. There were two diabetics (5%). The majority of patients ( $n=28$ ) were smokers, while eight patients had stopped smoking recently. Eleven (31%) of the patients had undergone previous vascular surgery (three contralateral iliac TEA, two ipsilateral iliac TEA or PTA, three crossover bypass, three infrainguinal ipsilateral bypass). Informed consent was given by all patients, and the study was approved by the local ethical committee. Ankle-brachial index (ABI) was measured before and after PTA.

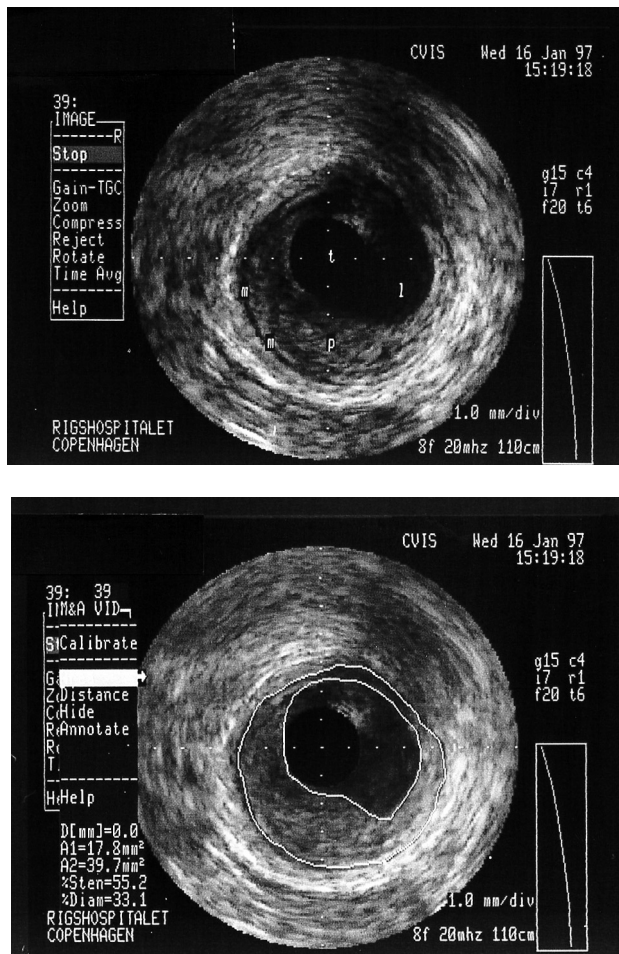
The PTA was performed intraoperatively in eight (22%) patients to improve the inflow prior to a femoro-femoral crossover bypass. The remainder were performed percutaneously in the department of interventional radiology. The PTA was performed with a 7–9 mm balloon (Olbert catheter, Meadox-Surgimed, Denmark) introduced through a 8–9 F sheath, positioned percutaneously or directly (during surgery) in the common femoral artery. In 16 (44%) of the stenoses a stent was deployed (Strecker stent, 7–9 mm, Boston Scientific, Denmark). During the procedure a median of 5000 units (range: 2500–9000) of heparin were administered intra-arterially. The arteriograms were only in a single plane, according to the routine of the department. The degree and length of stenosis were measured angiographically before and after the intervention. In four of the intraoperatively performed angioplasties the angiogram was not stored for later evaluation. The degree of stenosis was evaluated by comparing the diameter in the stenosis to the diameter of a seemingly normal segment of the artery. The presence of calcifications and dissections in the plaques were assessed qualitatively. Patency of the superficial and the deep femoral artery was noted.

The intravascular ultrasound examination was performed with a 20 MHz transducer mounted in the tip of a 8 F catheter (CVIS Cardiovascular Imaging Systems Inc., Sunnyvale, California, U.S.A.). Proximal to the transducer a rotating mirror reflected the ultrasound beam to 360 degrees of the vessel, producing trans-sectional images displayed on a monitor and stored on a S-VHS videorecorder. The catheter was introduced in the vessel over a guidewire through the arterial sheath used for the angioplasty catheter and advanced in retrograde fashion. The position of the catheter tip was recorded under fluoroscopy. Bony landmarks and branches of the vascular tree were

used to confirm the positioning of the IVUS catheter. The CVIS system enabled off-line measurements of the free luminal cross-sectional area and diameter as well as the media-bounded cross-sectional area and diameter. The boundaries between the blood filled lumen and the plaque/vessel wall, and between the intima and media, was outlined using a trackball on the video recordings. Difficulties in discerning between hypochoic plaque and blood was solved by reviewing the cross-section in motion, where the pulsation of the vessel wall can be observed. The free luminal area was defined as the area within the inner lining of the intima (same as the blood filled area), and the media-bounded area was defined as the area within the outer lining of the intima. The degree of stenosis and the plaque area was calculated from the media-bounded and free luminal areas (Fig. 1).

Qualitative parameters, which could be evaluated with IVUS, included the heterogeneity of the plaque. If calcifications were present in the plaque, it was categorised as heterogeneous, while soft plaques without calcification had a homogeneous appearance. An eccentricity index, the degree of calcification and the degree of dissection were evaluated on digitised ultrasound pictures. The pictures were transferred from the IVUS video recorder to a computer with an imaging program (Image-pro plus, Media Cybernetics, Silver Spring, U.S.A.). The eccentricity index was calculated, relating the part of the circumference of the blood filled lumen, bounded by a normal intima to the part bounded by plaque. If atheroma was present in the whole circumference of the intima, the index would be 0 and the plaque categorised as concentric. The degree of calcification and dissection was measured by relating the part of the luminal circumference with dissection or calcification to the total luminal circumference. The length of the dissections could not be directly evaluated. A dissection was defined as a splitting of the layers in the vessel wall, either between the intima and the media or in the intima itself, creating a flap.

Following discharge all patients were followed-up by duplex scanning after 3, 6, 12, 18 and 24 months, using a B&K 3535 scanner (Bruel and Kjaer medical) with a 3.5 MHz phased array transducer. At each visit patients were asked about clinical symptoms and smoking habits, pulses were palpated and ABI was measured. On duplex any change in the velocity profile was noted. A stenosis of more than 50% on duplex was defined as an increase in peak systolic velocity by a factor 2 or more.<sup>17</sup> This finding on the site of previous intervention, along with a significant decrease in SABI to the level before the intervention, were indicative of a non-patent reconstruction.



**Fig. 1.** IVUS image of an iliac artery with an eccentric soft plaque. (Top) The transducer (t), creates a black area in the centre of the transactional view. The lumen (l) is bordered by the intima, which is thickened by soft plaque (p) in the lower left part of the artery. The media (m) is represented by a black ring outside the intima. The shadow from the transducer at twelve to two o'clock is an artefact, which arises from the connection from the transducer passing by the mirror. (Bottom) The outer and inner lining of the intima have been marked. The area of the lumen and the media-bound area are calculated and shown in the lower left corner of the picture, along with the degree of stenosis and diameter reduction, which have been calculated from these two areas.

### Statistics

Non-parametric statistics were used. The Mann-Whitney rank sum test was used for analysis of unpaired continuous data. Paired continuous data were evaluated by the Wilcoxon-Pratt test. Correlation between continuous data were evaluated with Spearman's rank correlation analysis. Patency rates were calculated by Kaplan-Meier's life table method and compared by Log rank test. For comparison of arteriography and IVUS in the evaluation of the degree of stenosis, in addition to Spearman correlation analysis, the method described by Bland and Altman<sup>18</sup>

was used, in which the difference between the two measurements is compared to the average. Kappa statistics were used to assess the agreement between the two methods on categorical qualitative data.

### Results

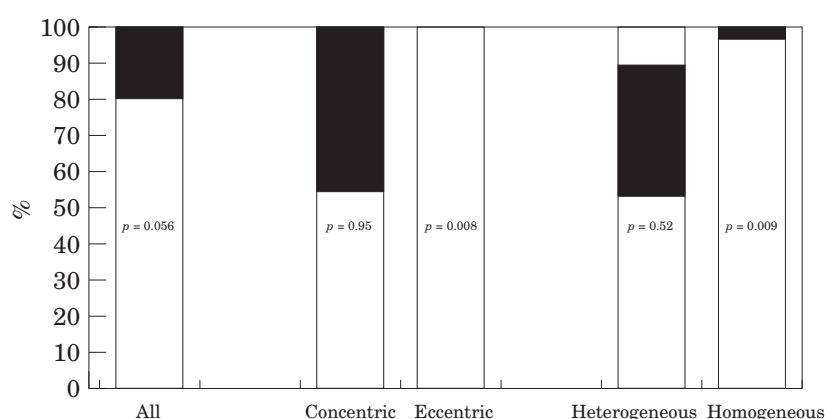
Immediate arteriographic success was obtained in all 37 stenoses treated with PTA. Three patients (8%) developed complications. In one case the ultrasound catheter caused a displacement of the stent of 1 cm. However, this had no consequence as the stenosis was still covered by the stent, and the stent was better anchored by further dilatation. One patient had a haemorrhage in the groin, which was treated by compression. The final complication was due to embolisation, which manifested itself 2 weeks after the intervention by a trash foot. Due to the late acknowledgement of the symptoms nothing was done, and the symptoms resolved spontaneously within 2 months.

### IVUS

The following plaque morphology was seen before PTA evaluated by IVUS: the distribution of the plaque was concentric in 15 (40%) and eccentric in 22 (60%) of the stenoses. Calcifications could be seen in 27 (73%) of the stenoses, while the remaining 10 (27%) plaques were soft plaques without calcifications. After PTA intimal lesions were detected in 27 (73%) of the plaques. The dissections measured from 28 to 180 degrees of the circumference of the lumen. There was no correlation between the amount of calcification and the extent of the dissection. The effect of PTA and stent measured by IVUS can be seen in Table 1. The results are given as median and range. A significant rise in free luminal diameter and area as well as in media-bounded area and diameter could be seen, and there was a significant reduction of the degree of stenosis. The reduction in plaque area did not reach statistical significance. There was, however, a large variation in effect between the individual arteries: in two arteries no luminal gain was achieved, in 16 arteries stretching was the only effect of PTA, while plaque compression alone accounted for the luminal gain in nine arteries. In the remaining 10 arteries both compression and stretching contributed to the luminal gain. When the relative contribution to the free lumen area gain from plaque compression and from stretching was compared there was a tendency toward a

**Table 1.** The quantitative IVUS measurements, median (range). The differences between the measurements before and after PTA and stent deployment were tested with the Wilcoxon–Pratt test.

	Luminal diameter mm	Free luminal area mm <sup>2</sup>	Media bounded area mm <sup>2</sup>	Plaque area mm <sup>2</sup>	Degree of stenosis %
Before PTA ( <i>n</i> = 37)	3.8 (0–8)	16.5 (0–65)	71 (20–133)	53 (16–87)	75 (41–100)
After PTA <i>p</i> value	5.5 (3.2–9.7) <0.001	36 (10–75) <0.001	86 (29–162) <0.001	43 (18–89) 0.057	57 (25–74) <0.001
Before stent ( <i>n</i> = 16)	5.8 (3.3–8.4)	36.5 (16–58)	85.5 (47–123)	47 (31–89)	59 (37–73)
After stent <i>p</i> value	6.2 (4.5–8.2) 0.13	36.5 (22–60) 0.21	88 (51–125) 0.02	49 (28–80) 0.38	57 (36–68) 0.31

**Fig. 2.** The difference in contribution to the luminal gain after PTA from stretching and compression according to plaque morphology. The *p* values are the result of the Wilcoxon–Pratt test for each column, and shows that there is a significantly higher contribution from stretching than from compression in arteries with eccentric and arteries with homogeneous plaques. (□) Stretching; (■) compression.

larger contribution from stretching than from plaque compression ( $p=0.056$ ) (Fig. 2).

When categorised into eccentric/concentric and homogeneous/heterogeneous lesions there was a difference in the effect of PTA: in the arteries with concentric lesions the contribution from plaque compression (33%) and stretching (52%) did not statistically diverge ( $p=0.95$ ), while in the eccentric plaques the lumen enlargement was primarily due to stretching ( $p=0.008$ ) (Fig. 2). The effect of PTA on arteries with homogeneous plaques was mainly stretching ( $p=0.009$ ), while the lumen gain in the arteries with calcified lesions was due to both stretching and compression ( $p=0.42$ ). The differences in luminal gain and plaque compression between arteries with concentric plaques and arteries with eccentric lesions were significant, while the difference in stretching were not. There was no significant difference in either mechanism between homogeneous and heterogeneous plaques.

### Arteriography

It was only possible to evaluate the presence of calcification and dissection in 33 and 29 of the patients. Calcifications were present in 14 (42%) cases as opposed to 27 (73%) when evaluated by IVUS, and the agreement between the two methods was poor, ( $\kappa=0.01$ ). Dissections were detected in 15 (52%) of the arteries after PTA as opposed to 27 (73%) when evaluated by IVUS; the agreement between the two methods on this parameter was moderate,  $\kappa=0.44$ . The degree of stenosis before PTA assessed from the arteriographies were median 70% (35–99), and the residual stenosis 20% (0–70). There was a significant correlation with IVUS when comparing the degree of stenosis before PTA,  $r=0.44$ ,  $p=0.023$ . This correlation could not be demonstrated when comparing the residual stenosis,  $r=0.012$ ,  $p=0.96$ . Using the method of Bland and Altman, IVUS assessed the stenosis to be 4% more severe before PTA than the arteriography



(range  $-36$ – $40\%$ ), while the mean difference for the residual stenosis were  $32\%$  (range  $-25$ – $71\%$ ).

### Stents

Stents were deployed in 16 (43%) of the 37 stenosis. The indications for stenting were residual stenoses, evaluated from the control arteriography, in the majority of cases ( $n=15$ ) and a large dissection in one case. There were significantly higher degrees of arteriographic residual stenoses in the arteries which were subsequently stented, than in the arteries where the arteriographic result of PTA was satisfactory ( $p<0.01$ ), while there was no difference in residual stenoses between the two groups when evaluated by IVUS ( $p=0.6$ ). Deployment of the stents reduced the degree of stenoses evaluated by arteriography ( $p<0.01$ ), while most of the quantitative measurements of IVUS did not change significantly, Table 1. The only effect from the stent deployment, assessed by IVUS, seemed to be dilatation of the vessel ( $p=0.02$ ). There was no significant change in the eccentricity of the plaque after stent deployment.

### Follow-up

The ABI rose from median 0.6 before (range 0.3–1.0) to 0.8 after (0.5–1.2) the intervention and was 0.78 (0.3–1.1) at 3 months ( $n=37$ ). After 6 months the median ABI was 0.75 (0.4–1.1) ( $n=30$ ), at 12 months 0.84 (0.5–1.1) ( $n=17$ ), 18 months 0.8 (0.4–1.1) ( $n=17$ ) and at 24 months 0.9 (0.5–1.0) ( $n=12$ ). At discharge the Foutaine stage had been improved in 25 (68%), deteriorated in one (3%) and remained unchanged in nine (24%) patients compared to the preoperative stage. Two patients (5%) could not be evaluated before discharge. After 3 months of follow-up four patients had deteriorated due to restenoses. Two further arteries had occluded, but these patients remained claudicants. The primary patency rate after a median follow-up time of 13 months (range 2–36) was 0.72, since nine of the patients developed restenoses within the first year of observation. No patients developed complete occlusion during the time of observation. Seven patients underwent re-PTA, one patient had a bifemoral bypass inserted, while the last patient was treated conservatively. Three of the redo intervention developed restenoses giving a secondary patency rate after 1 year of 0.86.

The quantitative IVUS measurements: free lumen

area and diameter were significantly related to patency (Table 2). Qualitatively calcified plaques were associated with a significantly higher patency rate than soft plaques ( $p=0.05$ ) (Fig. 3). The presence or absence of dissections could not be related to the outcome, neither could the eccentricity of the plaque have any influence on the patency. The arteriographic evaluation of the residual stenosis, calcification and dissections did not have any predictive value. The lesion site and the run off were unrelated to patency. There was no difference in outcome between the stented and non-stented vessels.

### Discussion

Intravascular ultrasound allows the mechanism of balloon angioplasty to be studied in detail by its ability to visualise the plaque morphology, and to quantify the changes in diameter and area before and after intervention. Several papers have described the effect of PTA, using IVUS pre- and postintervention, in the coronary<sup>1–5</sup> and in the femoral arteries<sup>7–9</sup> and found that the gain in free lumen area was achieved by both plaque compression and stretching of the arterial wall, with the major contribution to the effect arising from stretching. Contrary to these results the only work, to our knowledge, thoroughly describing the effect of PTA on iliac arteries,<sup>10</sup> found that compression of the plaque was the major contributor to the luminal gain. The discrepancy between this and other studies has been thought to be due to the different type of arteries studied. We therefore expected that our study of 37 iliac arteries would support the findings of the previous iliac study,<sup>10</sup> but this was not the case. Our results showed, in accordance with the numerous other studies mentioned above, that balloon dilatation seems to exhibit its effect mainly by stretching of the arterial wall. There was, however, much variation between the individual lesions in our study as in the studies of Braden *et al.*<sup>1</sup> and The *et al.*<sup>8</sup>

In the present study there seemed to be a different response to PTA according to the morphology of the plaques, which have not been described in the iliac arteries before. In soft plaques the predominant effect was an increase in the media-bounded area (stretching), while calcified plaques showed no significant difference between compression and stretching. This difference, also noted by Potkin *et al.*<sup>2</sup> in coronary arteries, is presumed to be because the dilating force of the balloon is easily transmitted to the rest of the arterial wall through soft plaque, while calcification produces more resistance. If dissection occurs in the

Table 2. The predictive value of the different measurement from IVUS and arteriography.

	Luminal area	Luminal diameter	% stenosis, IVUS	Calcifications	Dissection	Eccentricity	Residual stenosis, angiography	Location	Run off	Stent
Categories	≤35 mm <sup>2</sup> / >35 mm <sup>2</sup>	≤5 mm / >5 mm	≤60% / >60%	Yes/no	Yes/no	Ecc./conc.	+ / -	Ext/com	Good/poor	Yes/no
Number of patients	16/21	12/25	25/12	27/10	27/10	22/15	25/12	12/25	29/08	16/21
Patency rates	0.3/0.7	0.2/0.8	0.7/0.3	0.75/0.25	0.76/0.62	0.6/0.4	0.7/0.3	0.7/0.7	0.65/0.35	0.7/0.7
Log rank, <i>p</i> value	0.01	0.046	0.4	0.05	0.24	0.55	0.4	0.49	0.3	0.43

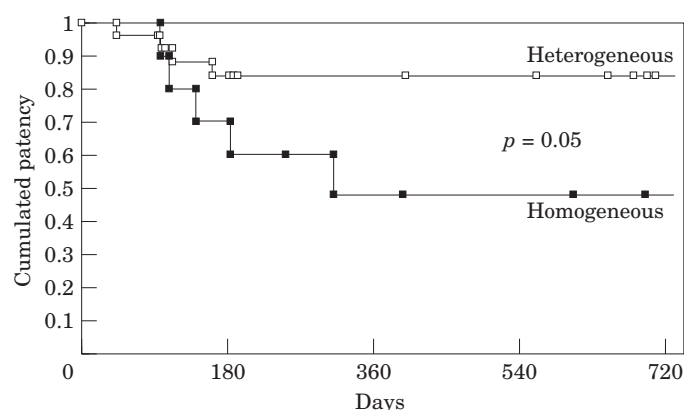


Fig. 3. The patency rate of arteries with heterogeneous ( $n=27$ ) plaques compared to the patency rate of homogeneous plaques ( $n=10$ ) by the Log-rank test. (□) Heterogeneous; (■) homogeneous.

calcified plaque, part of the vessel wall becomes susceptible to dilatation and stretching can occur. In accordance with this theory, we found that the eccentric plaques which leave part of the vessel wall exposed responded to PTA primarily by stretching. It must be pointed out that the method of measuring the eccentricity of the plaques varies a lot between different studies, which may explain some of the discrepancies.

The correlation between arteriography and IVUS in the evaluation of the degree of stenosis have been shown to be good before PTA, but poor after the intervention.<sup>19-21</sup> We were able to confirm these findings in the present study. The explanation for this lies in the fact that the arteriography is a luminogram. As long as the inner surface of the vessel is smooth the agreement with IVUS is reasonable, but when the inner surface is fractured by intimal defects, the contrast will fill out these defects and the luminogram will appear normal in certain planes and abnormal in others even though residual stenoses may be present or absent.<sup>21</sup>

Severe residual stenosis, evaluated by arteriography, was the indication for stent deployment in 15 of 16 cases in our study, and the arteriographic degree of stenosis did significantly diminish after stenting. In contrast, measurements of residual stenosis based on IVUS did not change after stent deployment, and neither did most other quantitative parameters (Table 1). Only a minor change in media-bounded area (stretching) was detected. These findings of complementary informations from IVUS and arteriography with limited changes in the quantitative IVUS parameters, are confirmed by Arko *et al.*<sup>11</sup> and by similar studies in coronary arteries.<sup>12,15</sup> Mudra *et al.*<sup>15</sup> used a combined IVUS balloon catheter to evaluate the effect of stenting in 18 coronary arteries, and found that despite an adequate angiographic result, IVUS did not show optimal stent expansion, and additional balloon

inflations were subsequently carried out in order to obtain a satisfactory result. In a recent study<sup>14</sup> measuring flow velocities with a Doppler flow wire before and after PTCA and stenting, no significant rise in flow velocity was detectable after PTCA despite angiographic improvement. In 17 of the 42 patients an IVUS examination was performed before and after stenting, and in this study a larger luminal area was detectable by IVUS after stenting and was accompanied by a rise in the flow velocity rate. The improvement in flow velocity after stenting but not after PTCA was presumed to be due to the smoothed surface accomplished by the stent – eliminating irregularities of the intima and remodelling the plaque toward a more circumferential distribution. A tendency toward a circumferential remodelling of the plaque leading to a more concentric distribution was also observed by Laskey *et al.*,<sup>12</sup> who examined 12 coronary arteries, but in the present study this remodelling of the plaque did not reach statistical significance. In the *in vitro* and animal study of iliac stenting by Cavaye *et al.*<sup>16</sup> an improvement in cross-sectional area and a change in ellipticity was noted after stenting in the *in vitro* arteries, while no change was detected in either parameter by IVUS in the canine arteries.

### Follow-up

The detailed description of the mechanisms of angioplasty is, of course, of interest from an academic point of view, but the method is only useful if a clinical impact can be shown. Most authors agree that free lumen area and the residual stenosis is of significant importance for the patency of the procedure. Not many have been able to relate the morphology of the plaque

to the patency. Honey *et al.*<sup>6</sup> examined 47 coronary arteries, and showed that concentric plaques without rupture or dissection had a lower patency rate than other morphologies. This was supposed to be due to elastic recoil, since the elastic properties of the wall had not been broken. In our study of the outcome after 18 femoral PTA<sup>19</sup> the lesions which caused early reocclusion were all characterised by soft plaques without dissections and with considerable residual stenosis. Treatment of calcified plaques, and plaques with dissections resulted in better patency rates. The degree of residual stenoses and the diameter of the free lumen diameter were also correlated with patency. The predictive value of the diameter of the free lumen and the heterogeneity of the plaque was confirmed in the present study of iliac angioplasty. In addition, we also found that the free lumen area was a predictor of patency, which is in accordance with the findings of Gussenhoven *et al.*<sup>22</sup> in their study of 115 femoral PTA. It seems that the post-interventional size of the free lumen and to some extent also the morphology of the plaque were the true predictors of outcome, no matter whether it was achieved by stretching or compression.

Intravascular ultrasound used as a control procedure after femoropopliteal or coronary angioplasty has revealed promising results in predicting the outcome of the intervention.<sup>19,22,25</sup> In these arteries the benefit of a better control procedure could be significant due to the relatively low patency of these interventions. In the iliac arteries, however, the patency of PTA is relatively high<sup>23,24</sup> and any improvement in the results is therefore difficult to achieve. However, intravascular ultrasound could be useful in deciding when a stent should be used. The indications at the moment, are major dissections or residual stenosis, assessed by arteriography, and pressure gradients. Our study, however, reveals a discrepancy between IVUS and arteriography when evaluating residual stenosis and dissections. Given, that the measurements and description of plaque morphology by IVUS are more predictive for the outcome than the arteriographic evaluation, we believe that IVUS is superior in this respect than arteriography. This might save the cost of some stents that would otherwise be unnecessarily deployed, and improve the patency of other arteries with a residual stenosis missed by arteriography. The lack of change in the quantitative measurements after stent deployment might indicate that further dilatation might be justified, and IVUS should be used as the ultimate control procedure after stenting. However, limitations of ultrasound imaging of stents, due to shadowing and transducer-stent reverberations, which can prevent the visualisation of the adaption to the

vessel wall, should be recognised and taken into consideration when evaluating the result.<sup>26</sup> Another, more practical, limitation of intravascular ultrasound is the price of the single use catheters, which is still high, though prices have declined during the last few years. Calcifications causes shadowing, which might hide underlying structures. The length of the dissections, which also might influence the outcome of interventions,<sup>27</sup> can only indirectly be evaluated by measuring the length of the withdrawn catheter. 3D images obtained during mechanical withdrawal of the catheter will solve this problem in the future.

In conclusion, IVUS is able to accurately document the effect of PTA and stenting in the iliac arteries, and to predict the outcome of the intervention. The luminal gain and reduction in degree of stenosis seems to be accomplished primarily by stretching of the arteries and to a lesser extent by plaque compression. Stenting does not change the IVUS measurements. The patency seems to be related to the size of the free lumen and the heterogeneity of the plaque as determined by IVUS.

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